

The Ohio Field Office Pollution Prevention & Energy Efficiency Closure Plan









Ashtabula Environmental Management Project (AEMP)



Chemical Extraction Soil Washing System

RMI is removing uranium from contaminated soil at the Ashtabula Environmental Management Project. A soil washing plant that employs a chemical extraction technology was constructed at the Ashtabula site to reduce the cost for remediation of contaminated soil. The process utilizes a heated carbonate solution to leach the uranium from the soil. This approach results in contaminant removal efficiencies of approximately 85% and volume reductions approaching 98%. Clean soil product from the soil washing operation is analyzed to ensure that free release standards have been met. Following verification analyses, the clean soil product is used as clean backfill on the site. The soil washing process provides a savings of approximately \$300 per ton when compared to the total life-cycle costs to ship and bury the soil. To date approximately 11,000 tons of contaminated soil have been successfully cleaned resulting in a cost savings of over \$2.2 million. The soil washing plant has provided a clean soil product that meets all regulatory requirements for reuse as clean backfill.

Columbus Environmental Management Project (CEMP)



CNS 10-160B Cask System

The Battelle Columbus Laboratories Decommissioning Project (BCLDP) is removing residual radioactive contamination from Battelle facilities and grounds located at Battelle's site near West Jefferson, Ohio. Transuranic (TRU) waste resulting from decontaminating nuclear hot cells and a building that housed a nuclear research reactor is to be shipped to a U.S. Department of Energy facility. The RH-72B cask was specifically designed for transporting TRU waste, but will not be available until fiscal year 2002. BCLDP is to begin shipping its remote-handled (RH) TRU by the beginning of the second quarter of fiscal year 2001. Using the CNS 10-160B Cask rather than the RH-72B cask will reduce TRU waste, transportation, and handling costs by more than 60 percent (approximately \$4 million) because more drums can be moved per shipment. Using the CNS 10-160B also will accelerate the shipment of higher activity low-level waste. Availability of the 10-160B Cask offers the possibility of shipping lower gamma dose RH TRU waste directly to the Waste Isolation Pilot Plant for placement in a shielded overpack for disposal as contact-handled TRU.

Transuranic Waste Laundry System

Disposal options for transuranic (TRU) waste are limited, and its required characterization can be expensive. Cloth materials, such as mop heads and rags, can easily become contaminated to higher levels because of their light-weight. A process that can reduce the level of or remove contamination on such items without generating significant secondary waste can be very beneficial during hot cell decontamination. The **TRU Laundry System** controls contamination by containing both the working fluid and the contaminants during cleaning. The only loss of the working fluid is the residual amount that remains on the cloth materials when they are removed from the system. The external bag filter can be changed with radioactive material in it. By reducing the amount of TRU waste for disposal, the system will save BCLDP approximately \$1.6 million.



HEPA Exhaust Diffuser

Portable high efficiency particulate airborne (HEPA) ventilation units are used to control staff exposure to airborne radioactive material at a Battelle site near West Jefferson, Ohio. High-velocity exhaust flow from these portable ventilation units can cause resuspension of loose contamination from the uncleaned surfaces (such as walls and overhead beams) in contaminated work areas. This increases the potential exposure to workers, requiring additional radiological monitoring. The **HEPA Exhaust Diffuser** minimizes the resuspension of radioactive particles caused by the HEPA's exhaust and reduces the amount of airborne contaminants to which workers are exposed. At a cost of approximately \$1,000, the diffuser modification will reduce the level of potential exposure to workers and associated monitoring, saving almost \$500,000 per year.

Transuranic Waste Modeling

As radioactively contaminated waste is accumulated during decontamination and decommissioning of a Battelle site near West Jefferson, Ohio, its waste classification (e.g., transuranic, low-level) must be established. Disposal site regulations require that the waste be directly sampled or appropriately modeled. The dose-to-curie conversion chart converts measured gamma doses to curies. The chart makes it possible to identify TRU waste items in the field and expedites sorting and segregating TRU waste from low-level waste. Because waste does not have to be directly sampled, BCLDP will save over \$3 million using this **Transuranic Waste Modeling** system.

Geoprobe

The Battelle Columbus Laboratories Decommissioning Project (BCLDP) must monitor the soil and groundwater at a Battelle site near West Jefferson, Ohio, to assure that no contamination has resulted from decontamination activities. Traditional drilling methods for collecting subsurface samples are slow and expensive. Probing, mobilization, and sampling are fast with the **Geoprobe®**, and surface and subsurface disturbance is minimal. The **Geoprobe®** equipment is more economical to operate than rotary drilling machines, and the level of effort and labor required for **Geoprobe®** operation is much less than for conventional drilling. Using the **Geoprobe®** will save BCLDP approximately \$300,000.

Jaws of Life

A cutting and self-sealing method to remove service lines and contaminated equipment is needed. As part of its decontamination and decommissioning effort at a Battelle site near West Jefferson, Ohio, the Battelle Columbus Laboratories Decommissioning Project (BCLDP) must remove equipment quickly and efficiently. In addition, contaminated service lines must be removed without dispersing radioactive particles. The speed and flexibility of the **Jaws of Life** make it an important tool to minimize the cost of labor and materials in removing radioactive service pipes, conduit, and equipment. Using the **Jaws of Life** to cut these contaminated items will save the BCLDP approximately \$80,000, assuming the work can be performed in three-fifths the time normally required. Cutting pipe lines using the jaws of life will also avoid airborne dispersion of radioactive particles.

Sonatol Decontamination System

Decommissioning the hot cells at Battelle's site near West Jefferson, Ohio, could result in large volumes of transuranic (TRU) waste in the form of contaminated equipment and research residues. Characterizing and packaging this heterogeneous mix of materials under current disposal site requirements will be tremendously expensive. Cleaning contaminated equipment from the hot cells would drastically reduce the volume of TRU waste that would require characterization, packaging, shipping, and processing. It would also significantly reduce the risk of exposure to people and the environment to TRU waste particles. Depending on the nature of the contamination, more than 99 percent of the radioactivity on contaminated equipment, metal tubes, and scrap from the hot cells can be removed using the **Sonatol Decontamination System**, which will save the BCLDP an estimated \$4.5 million.



Pipe Explorer Surveying System

The presence of radioactive contamination in buildings at a Battelle site near West Jefferson, Ohio, requires that the Battelle Columbus Laboratories Decommissioning Project (BCLDP) characterize all sewer lines at the site suspected of being contaminated. The traditional approach is to excavate all suspect lines. The ability to quantitatively characterize such lines probably would show that a significant amount of pipe can be left in place, avoiding costly removal. The **Pipe Explorer**TM system can identify contaminated pipe drain segments, and only contaminated pipe would need to be excavated. Using the system would cost approximately \$0.2 million; however, it would conservatively save over \$5 million if it reduces the amount of pipe that needs to be excavated by only 25 percent.

Dual-Camera Video Documentation System

During packaging of remote-handled transuranic (TRU) waste inside hot cells at a Battelle site near West Jefferson, Ohio, visual confirmation of everything that is packaged into each waste container is necessary to meet the waste acceptance criteria of the disposal site. The alternative is to perform actual waste sampling and analysis, which is extremely costly for highly radioactive material. This **Dual-Camera Video Documentation System** effectively satisfies the U.S. Department of Energy's Waste Isolation Pilot Plant waste acceptance criteria. The system avoids the need to sample and analyze each item of waste.

Diamond Wire Saw

The Battelle Columbus Laboratories Decommissioning Project (BCLDP) must dismantle for bulk disposal an eight-foot-thick reactor bioshield at Battelle's site near West Jefferson, Ohio. Building access and workspace in the building are limited, and conventional dismantling methods (such as jackhammers, hoe-rams, and explosives) create a considerable amount of noise, dust, and vibration. These structures can be cut using a diamond-embedded wire saw, a technology used successfully in the nuclear power plant industry for structural modifications and reactor disassembly. Its use in dismantling highly reinforced radioactive concrete structures, such as shielding, nuclear facilities, and containment structures, has not been widespread. The **Diamond Wire Saw** increases productivity because structures can be dismantled in less time and with less manpower than required by conventional demolition methods. This technology provides more efficient material disposal, more effective contamination control, and lower personnel exposure than manual, conventional methods. Using the **Diamond Wire Saw** to dismantle the shield at the West Jefferson site will reduce BCLDP's costs by at least \$w70,000 and wave countless hours of time.

Fernald Environmental Management Project (FEMP)



Groundwater Re-injection Demonstration (#157)

Groundwater contaminated with uranium moving offsite in Great Miami Aquifer (sole source aquifer). The **Groundwater Re-injection Demonstration** was conducted to provide data that the re-injection of treated groundwater into the aquifer could reduce the overall treatment time for removal of the uranium contamination to below 20ppb. The analysis data indicates the re-injection technology could reduce the overall treatment time from 27 years for the baseline pump and treat remedy to 10 years when used in conjunction with an optimized extraction strategy. The baseline technology was estimated in February 2000 to cost \$81.6M, compared to an estimated \$67.3M cost of completion with use of the re-injection technology. The present net worth savings is estimated to be \$14.3M. DOE-FN has fully deployed the groundwater re-injection technology at the FEMP as of 09/30/00.



Personal Ice Cooled System (#1898)

Heat Stress for workers performing hazardous operations in anti-contamination clothing that trap body heat. Stay times on tasks and worker comfort and safety are reduced due to this heat stress. The **Personal Ice Cooled System (PICS)** is an undergarment type clothing that has tubing sewn into it through which cool water is circulated. The PICS was initially deployed at Fernald. The PICS have benefited in work being performed more safely and stay times have been demonstrated to increase by as much as four times. The baseline includes time for rest and recovery of the workers during high heat periods with reduced stay times for workers performing activities in layers of personal protective clothing. The use of the PICS increases stay times, productivity, and worker comfort and safety. The PICS have been deployed at Fernald beginning in 1998 in the Sample Line Project and the Building 68 D&D Project. Since that time, the PICS have deployed by at NTS, Hanford, Oak Ridge, Paducah, Savannah River, Sandia, Los Alamos, Pantex, Rocky Flats, Mound, Lawrence Livermore National Lab, Idaho, Carlsbad, Ashtabula, Columbus, Argonne, Portsmouth, and West Valley due to Fernald's introduction of the PICS to these sites through site visits and demonstrations. The PICS was used in the demolition of the Security and Industrial Relations buildings the past summer at Fernald.

Oxy-Gasoline Cutting Torch (#1857)

D&D project managers at Fernald needed a technology to cut heavy structural steel and equipment faster/better than the traditional oxy-acetylene torch. Through the Large Scale Demonstration and Deployment Project, Fernald found and evaluated the **Oxy-Gasoline Cutting Torch**. The results of the demonstration indicated that the oxy-gasoline cutting torch was superior to the oxy-acetylene torch currently in use. The oxy-gasoline cutting torch is significantly faster (43% - 200%) in cutting steel, and is capable of cutting thicknesses of steel not able to be cut by the baseline oxy-acetylene torch. The operation costs of the oxy-gasoline cutting torch were demonstrated to be 43% - 67% less than the baseline technology. The oxy-gasoline cutting torch was deployed at Fernald in 1997, 1998, 1999. Additionally, Fernald has deployed the oxy-gasoline cutting torch to Mound, Ashtabula, Hanford Idaho, Rocky Flats, Pantex, Oak Ridge, and Portsmouth. The oxy-gasoline torch was used to cut steel reinforcing rods during the demolition of the Security and Industrial Relations buildings the past summer at Fernald.

Integrated Technology Suite for Soils Characterization (#'s 2157, 2362 & 2361)

The soil remediation project needed a work process to accurately characterize soil for its radiological constituents, quickly identify areas above or below remediation criteria, and present information in a manner that clearly communicates directions to contractors. The **Integrated Technology Suite for Soils Characterization** is a real-time soil characterization system and methodology utilizing gamma spectroscopy instrumentation, vendor available field deployable gamma ray detection devices, and commercially available software, communication, and surveying devices in an innovative fashion. It provides real-time data analysis, display, and mapping of the results. The method relies on the successful field integration of data from four main pieces of real-time radiation detection equipment: the mobile radiation tracking system (RTRAK); the radiation scanning system (RSS); the high purity germanium detectors (HPGe); and the Gator. The innovative use of these four pieces of equipment has created a trio of real-time detection and analysis tools available to the project for use in various surface conditions for the accurate and quick radiological characterization of soils for segregation during the remediation project. The Integrated Technology Suite for Soils Characterization has been deployed at Fernald since 1998. Savings of \$15 million have been realized by this innovative approach as of the end of Fiscal Year 2000.

Cloverleaf Alpha Track Detector

The FEMP has a need to monitor radon and thoron concentrations around the K-65 Silos, waste pits and process area cost effectively and to monitor worker exposure to comply with 10 CFR 835, DOE's occupational radiation exposure protection requirements. The new one-of-a-kind detector is a small, lightweight plastic device with three chambers made to hold a nominally 1-cm square **Alpha Track Detector** (ATD). The housing design



provides for three simultaneous measurements. The removable cap of each chamber is perforated to allow ambient air to diffuse into the detection chamber. A removable ATD placed in the chamber is used to detect the combined response to both thoron and radon in the air. To differentiate between species, a foil diffusion barrier that stops thoron from reaching the detector is placed between the cap and the ATD in one of the chambers. The difference between the responses from two chambers is a measurement of the thoron concentration. The third chamber can be used as a control or for a duplicate measurement. The current method used at the FEMP is to measure radon and thoron concentrations at the perimeter only. The Cloverleaf Alpha Track Detector was deployed at the FEMP on 05/30/99. The current model is being redesigned to have 4 detection chambers to provide duplicate measurements for both radon and thoron. Following this redesign, the improved model will be deployed.

Miamisburg Environmental Management Project (MEMP)



Nochar Absorbent Polymer Oil Solidification Agent

Mound has reservoirs of highly tritiated and heavy metal laced waste oils as defined by the Resource Conservation & Recovery Act (RCRA) resulting from the operation of tritium handling glove boxes and hundreds of associated vacuum pumps. Over several decades, these oils became highly contaminated with tritium, which tends to replace hydrogen in the oil hydocarbons. Hazardous chemicals and metals including lead, chromium, barium, mercury and other metals, were introduced to the oils through normal operations. Petrochemicals, such as cyclohexane, were also added to the oils during pump cleaning processes. Under RCRA regulations, these oils must be handled as mixed waste for burial site disposal. Nochar Petro Bond Absorbent Polymer Oil Solidification Agent is an industrial product that solidifies and stabilizes mixed waste oils to make cleanup and disposal easier. Nochar provides a simple and effective disposal method for these mixed waste oils, which meets the waste acceptance criteria (WAC) requirements for burial at the Nevada Test Site (NTS). The Nochar agent absorbs oil with no mixing or required mixing equipment. With a combination or "formula" of high tech polymers, Nochar can be specifically designed to address the characteristics of waste oils existing at various DOE sites. It can be used for free liquid control in storage, transport, and disposal of radioactive and mixed waste oils. Baseline methods for disposal include incineration, long term storage for decay, and use of commercially available organic solidification agents. Nochar was deployed at Mound in August of 1999, and is currently used as the baseline method for mixed waste oil disposal. It has since been deployed at several DOE sites including Ashtabula (AEMP), Princeton Plasma Physics Lab (PPPL), Sandia National Laboratory (SNL), Savannah River Site (SRS) and Rocky Flats Environmental Technology Site (RFETS) to solve a variety of mixed waste disposal issues.

Disposition and Reuse of Contaminated Equipment

As a closure site, much of Mound's equipment is planned for disposal in the near future. Instead of considering disposal as a first option, Mound considered the additional benefits to the closure project by finding a way to reuse some equipment at another facility or company. For some equipment, cost and schedule savings to DOE as well as the receiving companies can result. Mound effectively applied the process knowledge and methodology developed by the **DOE National Center of Excellence for Metals Recycle (NMR)** in Oak Ridge, TN, to facilitate equipment reuse at many DOE sites. NMR checklists stepped through the entire process and aided in evaluating potential equipment reuse propects. NMR provided sample commercial terms and conditions that have been used at many DOE sites. Mound then transferred used, tritium-contaminated equipment to a commercial company by means of a bartered sale agreement. The equipment was marked for disposal, and the baseline costs included packaging, shipping, and burial at a licensed radiological and mixed waste repository. The MEMP agreement was negotiated, and the first shipment of used equipment was completed in October 2000. Additional shipments will follow. As a result, DOE expects to avoid \$400,000 in equipment disposal costs and an additional



\$1,000,000 by shortening the schedule for site closure. Working together, MEMP, NMR, and BWXTO concluded a bartered sale and transfer of contaminated tritium processing equipment from DOE Mound to a facility in Texas licensed by a U.S. Nuclear Regulatory Commission (NRC) agreement state for reuse in the pharmaceutical industry. This action resulted in significant cost savings to MEMP and to the commercial company.

Burndy Crimper

The tritium processing facilities at Mound encompass miles of contaminated pipes and tubes, both single and double walled, used to transport tritiated gases. The Mound Exit Project requires that processing area lines be dismantled and packaged for offsite burial. The technology applied to assist in the dismantlement of these processing lines is the **Burndy Crimper**, which is an AC powered hydraulically assisted crimping tool. The crimper head weighs less than 8 lbs. and connects to the end of a 25 ft. hose. The cart-mounted pump enables the entire unit to easily move between job sites and provides sufficient hose to reach tubing in high bay areas. A battery powered unit with a shorted hose is also available. This portable lightweight crimping tool provies a gastight, or near gastight seals in tritium contaminated stainless steel and copper tubing up to 1 inch in diameter. Baseline approaches involve the use of saws, tube or bolt cutters, torches, and in some cases, secondary containment devices to capture any releases of tritium. Containment devices and/or the use of air supplied suits for workers are especially costly and have negative effects on productivity. The Burndy Crimper is a tool that ensures a leaktight seal to eliminate the need for additional containment devices or protective equipment. It was deployed at Mound in December of 1999 to remove tritium contaminated tubing in the SW Building. A second unit was ordered for upcoming work on the T-Building project.

WaterWorks Crystals® Aqueous Liquid Solidification Agent

The Tritium D&D program at Mound generates large quantities of low level tritium contaminated aqueous waste. The stabilization of this waste for shipment and disposal results in a weight, and in some cases, volume increase of the final waste form compared to the liquid waste. More effective stabilizing agents translate into larger waste loading per drum and a corresponding reduction in the cost of stabilization, transportation, and disposal. WaterWorks Crystals® manufactured by WaterWorks America, Inc. is an organic poly-acrylate that has very high absorbent capabilities for aqueous liquids. Under specific conditions, it achieves weight ratios of up to 200:1 water to absorbent. The product is non-toxic and non-biodegradable. It is highly resistant to the effects of radiation and withstands standard freeze/thaw test environments. There are other similar products in the polyacrylate family that have the same basic capabilities and limitations. These products work well with aqueous solutions and can tolerate some mineral/salt content along with the presence of inorganic sludges. They do not work for organic liquids. WaterWorks Crystals® require no mixing when added to a liquid and there is essentially no increase in volume. Baseline processes included immobilization agents and cement. Mound demonstrated the WaterWorks Crystals® technology in December 1999. Successful deployment tests have since been conducted at the Ashtabula Site (AEMP), Pantex Site, and Laboratory for Energy-related Health Research Site (LEHR) between January and September 2000.

West Valley Demonstration Project (WVDP)



Vitrification Expended Material Processing (VEMP) Program

The West Valley Demonstration Project (WVDP) is operating a system for vitrifying liquid high-level waste (HLW) resulting from commercial nuclear fuel reprocessing operations in the late 1960's and early 1970's. Operation of this system results in the generation of waste such as expended equipment and consumables within the shielded vitrification cell. These expended materials had been set aside for possible repair and reuse or



eventual disposition. The accumulation of excess materials requires innovative tools and techniques for remote handling, size reduction, cleaning and packaging. A number of tools have been developed or adapted from commercial equipment for use within the shielded cells.

Guillotine Saw

The **Guillotine Saw** is a power hack saw mounted to a welded guillotine-shaped frame that provides support for the saw. The saw is lifted by the Cell crane and attaches to a work piece using a remotely operated clamping mechanism. The saw is normally positioned in a vertical orientation to the work piece and has a maximum cutting capacity of 6-in. in diameter. Since the saw is provided with its own clamping mechanism, it can be used at various work locations within the Cell. The saw blade is remotely replaceable using mechanical manipulators and can cut to within a few inches of a horizontal surface. It is powered by 480 VAC and uses a stepped-down 480 to 120 VAC transformer. The Guillotine Saw has been used as the primary size reduction tool of the VEMP program. Its development is unique in that the saw had to be usable with the Cell's existing cranes, manipulators, and power supplies. No other technology was applicable in this situation. The saw has been in service since July 1999, to size reduce numerous melter thermowells, level probes, thermocouples, and a gauge assembly.

DT Band Saw

The **DT Band Saw** is a stainless steel 110 VAC portable band saw that has been modified for remote positioning and operation. The DT Band Saw was purchased from C. S. Unitec as an off-the-shelf item. The body of the unit is of stainless steel construction. The part number for the variable speed electric band saw model is 5 6047 0010. A pneumatic model is also available. The cutting blade's (from C. S. Unitec) part number is 9 2506 00240. This number specifies a 8 to 12 variable tooth per inch 44 7/8-in by ½-in M42 cobalt steel blade. The DT Band Saw can be used at a portable work station (not deployed to date) or at various work locations within the Cell. The saw has a cutting capacity of 7 1/4-in. in diameter and has a remotely replaceable blade. Since the saw is not fixed to the work piece, the cut angle is affected by the rate at which the saw is lowered from the crane onto the work piece or by positioning the saw with the manipulators. As with the Guillotine Saw, the DT Band Saw was modified to be usable with the Cell's existing handling equipment and power supplies. It allows for remote size reduction which is an improvement over baseline technologies that could only cut at one fixed location. The DT Band Saw was deployed in the Cell in June 2000, for the size reduction of a damaged Concentrator Feed Makeup Tank sample pump and the Melter View Periscope.

Modified Power Hawk® with Grabber

The Modified Power Hawk® with Grabber (or Grabber) is an electrically powered unit that is used in conjunction with the Cell's crane to lift or pick up cylindrical or flat items for transfer around the Cell interior and to the Maintenance Station. The unit is a weldment comprised of two clam shell fingered sections (two halves), an actuating device, and a lifting bail assembly. One half of the clam shell is stationary with three individual fingers and the other is moveable with four individual fingers. When actuated, the moveable finger section passes between the fingers of the stationary section to close creating an increasingly smaller opening in the center. The Grabber can pick up and hold items ranging in size from 1/4 to 7-in. in diameter and has a working load limit of 2,000 lb. It is unique in that the Grabber can lift and move items of varying shapes without handling bails typically used with standard lifting devices. The Grabber was deployed in the Cell in June 1999, and has been used for multiple lifting tasks since deployment.

Mini-max Modular IV Cleaning System

The **Mini-max Modular IV Cleaning System** or Mini-max is a commercial steam cleaning unit used to remove excess surface contamination from expended material prior to processing or for cleaning the exterior of filled waste cans before they exit the Vitrification Cell. The unit, model number 6609-44A, was purchased from PDQ Precision in Chula Vista, California. It develops 295 psi and requires 208 VAC, 30 amp, single-phase service. PQD Precision also sells a low output model which develops 195 psi. The Mini-max uses a distilled or demineralized water supply in one to five gallon containers.

Three 30-ft insulated wands with quick disconnects, wand attachments, and a portable cart were also purchased



with the unit. The attachments include a nozzle for cleaning external surfaces and internal surfaces of pipe or tubes and a restricted flow nozzle. The equipment was modified by WVDP for in-cell applications. The advantage of the Mini-max cleaner over the water spray wand method is that it uses significantly less water and thus produces significantly less contaminated liquid to process as a by-product of cleaning activities. The Minimax cleaner was deployed in the Cell in August 2000, to clean a waste handling can.

High-level Waste Tank Cleanout - Gamma Camera

Large underground tanks at the WVDP were used to store HLW from former commercial nuclear fuel reprocessing operations at the site. The majority of the waste from these tanks has been vitrified and stored in stainless steel canisters for ultimate shipment to a Federal repository. The remaining waste in the tanks is not uniformly distributed. Rather, it is located in, around and behind various structural members and other internal tank components. The remaining waste is being sluiced to the intake of transfer pumps for movement to the vitrification facility. A **Gamma Camera**, based on AIL's (Aircraft Instrument Laboratory) Standard Model 31 Gamma Camera, has been deployed in one of the underground tanks to help locate the remaining pockets of cesium bearing waste. The camera was initially deployed October 16 through October 20, 2000, to obtain images of the tank bottom, tank beam flanges, and the tank walls. Various deposits were pinpointed to help direct further tank cleanout activities. Additionally, it is expected that future deployments of the camera will help to determine the effectiveness of these cleanout activities. Prior to the deployment of the camera, the WVDP relied on video camera surveys of the tank internals to qualitatively indicate remaining pockets of waste. Deployment of the Gamma Camera significantly improved the effectiveness of tank sluicing activities by allowing targeting of specific areas, and minimizing "hit or miss" cleanout operations.

